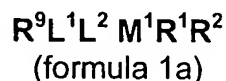


WHAT IS CLAIMED IS:

1. A composition comprising a mixture of racemic and meso isomers of metallocene compounds having the formula:

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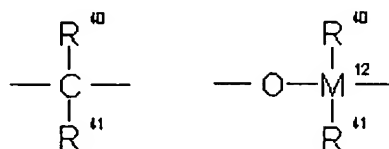
where L^1 and L^2 are identical or different ligands and are each a substituted mononuclear or polynuclear hydrocarbon radical selected from the group
10 consisting of substituted cyclopentadienyl, indenyl, tetrahydroindenyl, azurenyl, fluorenyl, azapentalenyl, thiapentalenyl or oxapentalenyl, which form a sandwich structure with atom M^1 therebetween,

R^1 and R^2 are identical or different and are each a hydrogen atom, an alkyl group of from 1 to about 10 carbon atoms, an alkoxy group of from 1 to about 10
15 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, an aryloxy group of from about 6 to about 10 carbon atoms, an alkenyl group of from 2 to about 10 carbon atoms, an OH group, a halogen atom, or a NR_2^{32} group, where R^{32} is an alkyl group of from 1 to about 10 carbon atoms or an aryl group of from 6 to about 14 carbon atoms, or R^1 and R^2 form one or more ring system(s),

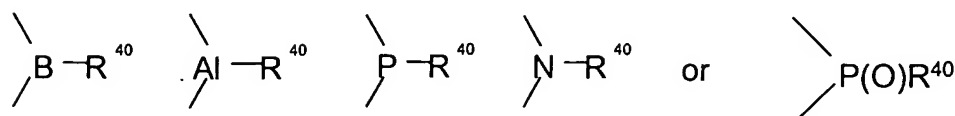
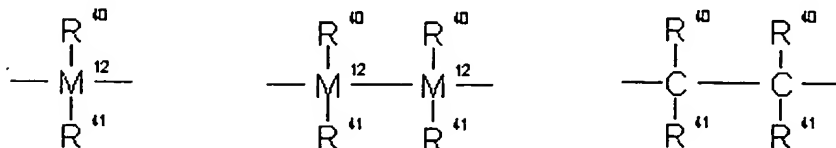
20 M^1 is a metal of group IVb of the Periodic Table of the Elements,

R^9 is a bridge between the ligands L^1 and L^2 having one of the structures:

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where R^{40} and R^{41} , can be identical or different, with or without heteroatoms, and are each an alkyl group having from 2 to about 30 carbon atoms, a fluoroalkyl group of from 2 to about 10 carbon atoms, an alkoxy group of from 2 to about 10 carbon atoms, an aryloxy group of from 6 to about 10 carbon atoms, an alkenyl group of from about 3 to about 10 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group of from 7 to about 40 carbon atoms, a substituted or unsubstituted alkylsilyl or arylsilyl group, or an arylalkenyl group of from 8 to about 40 carbon atoms, or R^{40} and R^{41} together with the atoms connecting them can form one or more cyclic systems, and if R^{40} and R^{41} are different and R^{40} is a hydrocarbon group of from about 4 to about 40 carbon atoms, R^{41} is a hydrocarbon group of from 1 to about 40 carbon atoms, M^{12} is silicon, germanium or tin, and wherein the mixture of racemic and meso isomers as synthesized has a weight ratio of racemic to meso isomers of greater than 5:1.

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2. The composition of Claim 1 wherein L^1 is a substituted cyclopentadienyl, indenyl, tetrahydroindenyl, azurenyl, fluorenyl, azapentalenyl, thiapentalenyl or oxapentalenyl,

L^2 is a substituted indenyl, tetrahydroindenyl, azurenyl, fluorenyl, azapentalenyl, thiapentalenyl or oxapentalenyl, and

20 the bridging unit R^9 is $R^{40}R^{41}Si=$, $R^{40}R^{41}Ge=$, $R^{40}R^{41}C=$ or $-(R^{40}R^{41}C-CR^{40}R^{41})-$, where R^{40} and R^{41} are identical or different and are each an alkyl group of from 2 to about 30 carbon atoms, an arylalkyl group of from 7 to about 14 carbon atoms or an alkylaryl group of from 7 to about 14 carbon atoms.

25

3. The composition of Claim 2 wherein R^{40} and R^{41} are different, R^{40} is a C_4 - C_{30} hydrocarbon group and R^{41} is a C_1 - C_{30} hydrocarbon group.

4. The composition of Claim 1 wherein L^1 and L^2 are identical or different and are each a substituted indenyl, azurenyl, fluorenyl, azapentalenyl, thiapentalenyl or oxapentalenyl, and

30

the bridging unit R^9 is $R^{40}R^{41}Si=$ or $R^{40}R^{41}Ge=$, where R^{40} and R^{41} are identical or different and are propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclo-pentyl, cyclo-pentadienyl or cyclohexyl.

5 5. The composition of Claim 4 wherein R^{40} and R^{41} are different, R^{40} is butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclopentyl, cyclopentadienyl, or cyclohexyl, and R^{41} is methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclopentyl, cyclopentadienyl or cyclohexyl.

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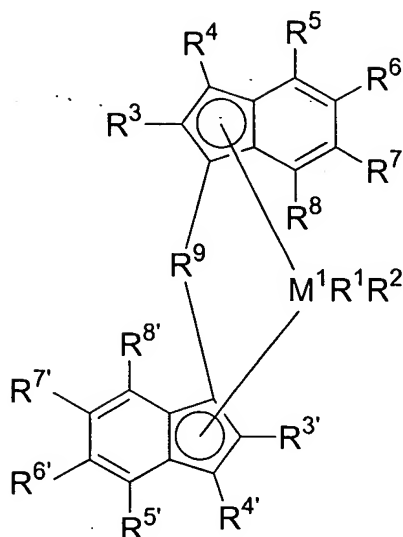
6. The composition of Claim 1 wherein the weight ratio of racemic to meso isomers is greater than 10:1.

15 7. The composition of Claim 1 wherein the weight ratio of racemic to meso isomer is greater than 15:1.

8. The composition of Claim 1 wherein the weight ratio of racemic to meso isomers is greater than 20:1.

20

9. The composition of Claim 1 wherein the compound has the formula:



(formula 1b)

- 5 where $R^3, R^4, R^5, R^6, R^7, R^8$ and also $R^{3'}, R^{4'}, R^{5'}, R^{6'}, R^{7'}$ and $R^{8'}$ are identical or different and are each a hydrogen atom or a linear, cyclic or branched group, with or without heteroatoms, selected from an alkyl group of from 1 to about 10 carbon atoms, an alkenyl group of from 2 to about 10 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group of from 7 to about 40 carbon atoms or an arylalkenyl group of from 8 to about 40 carbon atoms, or a substituted or unsubstituted alkylsilyl or arylsilyl group, with the proviso that R^3 and $R^{3'}$ are not hydrogen, and wherein two adjacent radicals R^5, R^6 or $R^{5'}, R^{6'}$, or R^6, R^7 or $R^{6'}, R^{7'}$, or R^7, R^8 or $R^{7'}, R^{8'}$ can form a hydrocarbon ring system.

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10. The composition of Claim 9 wherein at least one of $R^3, R^4, R^5, R^6, R^7, R^8, R^{3'}, R^{4'}, R^{5'}, R^{6'}, R^{7'}$ and $R^{8'}$ includes a heteroatom selected from the group consisting of Si, B, Al, O, S, N, P, F, Cl and Br.

20

11. The composition of Claim 9 where M^1 is zirconium or hafnium,

R¹ and R² are identical or different and are an alkyl group of from 1 to about 10 carbon atoms, an alkoxy group of from 1 to about 10 carbon atoms, an aryloxy group of from 6 to about 10 carbon atoms, or a halogen atom, or R¹ and R² together form one or more ring system(s),

5 R³ and R^{3'}, are identical or different and are each a linear, cyclic or branched group, with or without a halogen, selected from the group consisting of an alkyl group of from 1 to about 10 carbon atoms and an alkenyl group of from 2 to about 10 carbon atoms,

10 R⁴, R⁵, R⁶, R⁷, R⁸ and also R^{4'}, R^{5'}, R^{6'}, R^{7'} and R^{8'} are identical or different and are each a hydrogen atom, or a substituted or unsubstituted alkylsilyl or arylsilyl group, or a linear, cyclic or branched group, with or without heteroatoms, or an alkyl group of from 1 to about 10 carbon atoms, an aryl group of from 6 to about 10 carbon atoms, or the two adjacent radicals R⁵, R⁶ and R^{5'}, R^{6'} may form a hydrocarbon ring system,

15 R⁹ is R⁴⁰R⁴¹Si=, R⁴⁰R⁴¹Ge=, R⁴⁰R⁴¹C= or -(R⁴⁰R⁴¹C-CR⁴⁰R⁴¹)-, where R⁴⁰ and R⁴¹ are identical or different and are each an alkyl group of from 2 to about 30 carbon atoms, an arylalkyl group of from 7 to about 14 carbon atoms or an alkylaryl group of from 7 to about 14 carbon atoms.

20 12. The composition of Claim 11 wherein R⁴⁰ and R⁴¹ are different, R⁴⁰ is a hydrocarbon group of from 4 to about 30 carbon atoms, and R⁴¹ is a hydrocarbon group of from 1 to about 30 carbon atoms.

25 13. The composition of Claim 9 wherein

M¹ is zirconium,

R¹ and R² are identical or different and are methyl, chlorine or phenolate,

30 R³ and R^{3'}, are identical or different and are each a linear, cyclic or branched group, with or without a halogen, which is selected from the group consisting of an alkyl group of from 1 to about 10 carbon atoms and an alkenyl group of from 2 to about 10 carbon atoms,

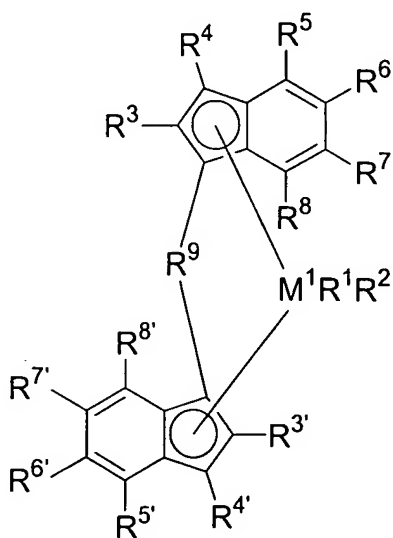
R⁴ and also R^{4'} are hydrogen,

R^5, R^6, R^7, R^8 and also $R^{5'}, R^{6'}, R^{7'}, R^{8'}$ are identical or different and are each a hydrogen atom or a linear, cyclic or branched alkyl group of from 1 to about 10 carbon atoms, or an aryl group of from 6 to about 10 carbon atoms, or the two adjacent radicals R^5, R^6 and $R^{5'}, R^{6'}$ form a hydrocarbon ring system, and

R^9 is $R^{40}R^{41}Si=$ or $R^{40}R^{41}Ge=$, where R^{40} and R^{41} are identical or different and are propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclopentyl, cyclopentadienyl or cyclohexyl.

14. The composition of Claim 13 wherein R^{40} and R^{41} are different and R^{40} is butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclopentyl, cyclopentadienyl or cyclohexyl and R^{41} is methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclopentyl, cyclopentadienyl or cyclohexyl.

15. The composition of Claim 1 wherein the compound has the formula:



(formula 1c)

where $R^3, R^4, R^5, R^6, R^7, R^8$ and also $R^{3'}, R^{4'}, R^{5'}, R^{6'}, R^{7'}$ and $R^{8'}$ are identical or different and are each a hydrogen atom, or a linear, cyclic or branched hydrocarbon group with or without heteroatoms and selected from an alkyl group of from 1 to about 10 carbon atoms, an alkenyl group of from 2 to about 10 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group of from 7 to about 40 carbon atoms or an arylalkenyl group of from 8 to about 40 carbon atoms, or a substituted or unsubstituted alkylsilyl or arylsilyl group, with the proviso that R^3 and $R^{3'}$ are not hydrogen and that R^5 and $R^{5'}$ are identical or different and are each a substituted or unsubstituted aryl group of from 6 to about 40 carbon atoms.

16. The composition of Claim 15 wherein at least one of $R^3, R^4, R^5, R^6, R^7, R^8, R^{3'}, R^{4'}, R^{5'}, R^{6'}, R^{7'}$ and $R^{8'}$ includes a heteroatom selected from the group consisting of Si, B, Al, O, S, N, P, F, Cl and Br.

17. The composition of Claim 15 wherein M^1 is zirconium or hafnium, R^1 and R^2 are identical or different and are an alkyl group of from 1 to about 10 carbon atoms, an alkoxy group of from 1 to about 10 carbon atoms, an aryloxy group of from 6 to about 10 carbon atoms or a halogen atom, or R^1 and R^2 together form one or more ring system(s), and

R^3 and $R^{3'}$ are identical or different and are each a linear, cyclic or branched group, with or without a halogen, and selected from the group consisting of an alkyl group of from 1 to about 10 carbon atoms and an alkenyl group of from 2 to about 10 carbon atoms, and

R^4, R^6, R^7, R^8 and also $R^{4'}, R^{6'}, R^{7'}$ and $R^{8'}$ are identical or different and are each a hydrogen atom or a linear, cyclic or branched alkyl group of from 1 to about 10 carbon atoms, with or without a heteroatom,

R^5 and $R^{5'}$ are identical or different and are each a substituted aryl group of from 6 to about 40 carbon atoms,

R^9 is $R^{40}R^{41}Si=$, $R^{40}R^{41}Ge=$, $R^{40}R^{41}C=$ or $-(R^{40}R^{41}C-CR^{40}R^{41})-$, where R^{40} and R^{41} are identical or different and are each an alkyl group of from 2 to about 30 carbon atoms, an arylalkyl group of from 7 to about 14 carbon atoms or an alkylaryl group of from 7 to about 14 carbon atoms.

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18. The composition of Claim 17 wherein R^{40} and R^{41} are different, R^{40} is a hydrocarbon group of from 4 to about 30 carbon atoms and R^{41} is a hydrocarbon group of from 1 to about 30 carbon atoms.

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19. The composition of Claim 15 wherein M^1 is zirconium,

R^1 and R^2 are identical or different and are an alkyl group of from 1 to about 10 carbon atoms, an alkoxy group of from 1 to about 10 carbon atoms, an aryloxy group of from 6 to about 10 carbon atoms or a halogen atom, or R^1 and R^2 together form one or more ring system(s),

15

R^3 and R^3' are identical or different and are each a linear, cyclic or branched methyl, ethyl, propyl, butyl, pentyl or hexyl,

R^4 and R^4' are both hydrogen,

R^6 , R^7 , R^8 and also R^6' , R^7' and R^8' are identical or different and are each a hydrogen atom or a linear, cyclic or branched alkyl group of from 1 to about 10 carbon atoms, with or without a heteroatom,

20

R^5 and R^5' are identical or different and are naphthyl, para-(C_1 - C_{10} -alkyl)phenyl, para-(C_1 - C_{10} -fluoroalkyl)phenyl, meta-(C_1 - C_{10} -alkyl)phenyl, meta-(C_1 - C_{10} -alkyl)phenyl, meta, meta'-(C_1 - C_{10} -alkyl)₂phenyl or meta, meta'-(C_1 - C_{10} -fluoroalkyl)₂phenyl,

25

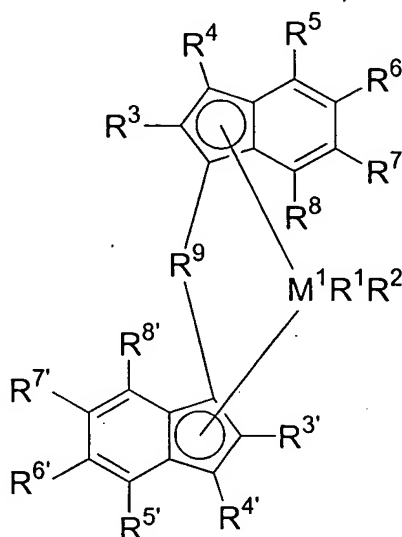
R^9 is $R^{40}R^{41}Si=$ or $R^{40}R^{41}Ge=$, where R^{40} and R^{41} are identical or different and are propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclo-pentyl, cyclo-pentadienyl or cyclohexyl.

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20. The composition of Claim 19 wherein R^1 and R^2 are identical and are methyl, chlorine, or phenolate.

21. The composition of Claim 19 wherein R^{40} and R^{41} are different and R^{40} is butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclopentyl, cyclopentadienyl or cyclohexyl, and R^{41} is methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclopentyl, cyclopentadienyl or cyclohexyl.

22. The composition of Claim 1 wherein the compound has the formula:



(formula 1d)

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where R^4 , R^5 , R^6 , R^7 , R^8 and also $R^{4'}$, $R^{5'}$, $R^{6'}$, $R^{7'}$ and $R^{8'}$ are identical or different and are each a hydrogen atom, a linear, cyclic or branched hydrocarbon group, with or without heteroatoms, and selected from the group consisting of an alkyl group of from 1 to about 10 carbon atoms, an alkenyl group of from 2 to about 10 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group of from 7 to about 40 carbon atoms or an arylalkenyl group of from 8 to about 40 carbon atoms, or a substituted or unsubstituted alkylsilyl or arylsilyl group, with the proviso that R^5 and $R^{5'}$ are identical or different and are each a substituted aryl group of from 6 to about 40 carbon atoms,

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R^3 is a linear hydrocarbon group, with or without a heteroatom, and selected from the group consisting of an alkyl group of from 1 to about 20 carbon atoms, an aryl substituted alkyl group of from 7 to about 40 carbon atoms and an aryl substituted alkenyl group of from 8 to about 40 carbon atoms,

5 $R^{3'}$ is a hydrocarbon group, cyclic or branched in the α position, with or without a heteroatom, and selected from the group consisting of an alkyl group of from 3 to about 20 carbon atoms, an alkenyl group of from 3 to about 20 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group of from 7 to about 40 carbon atoms and an arylalkenyl group of from 8 to about 40 carbon atoms.

23. The composition of Claim 22 wherein M^1 is zirconium or hafnium, R^1 and R^2 are identical or different and are an alkyl group of from 1 to about 10 carbon atoms, an alkoxy group of from 1 to about 10 carbon atoms, an
15 aryloxy group of from 6 to about 10 carbon atoms or a halogen atom, or R^1 and R^2 together form one or more ring system(s),

R^3 is a linear alkyl group of from 1 to about 10 carbon atoms or an alkenyl group of from 2 to about 10 carbon atoms, with or without a halogen,

$R^{3'}$ is an alkyl group of from 3 to about 20 carbon atoms and cyclic or
20 branched in the α position, an alkenyl group of from 3 to about 20 carbon atoms, or an alkylaryl group of from 7 to about 20 carbon atoms,

R^4 , R^6 , R^7 , R^8 and also $R^{4'}$, $R^{6'}$, $R^{7'}$ and $R^{8'}$ are identical or different and are each a hydrogen atom or a linear, cyclic or branched alkyl group of from 1 to about 20 carbon atoms, with or without a halogen,

25 R^5 and $R^{5'}$ are identical or different and are each a substituted aryl group of from 6 to about 40 carbon atoms, selected from para-(C_1 - C_{10} -alkyl)phenyl, meta-(C_1 - C_{10} -alkyl)phenyl, meta, meta'-(C_1 - C_{10} -alkyl)₂phenyl, and

R^9 is $R^{40}R^{41}Si=$, $R^{40}R^{41}Ge=$, $R^{40}R^{41}C=$ or $-(R^{40}R^{41}C-CR^{40}R^{41})-$, where R^{40} and R^{41} are identical or different and are each an alkyl group of from 2 to about
30 30 carbon atoms, an arylalkyl group of from 7 to about 14 carbon atoms or an alkylaryl group of from 7 to about 14 carbon atoms.

24. The composition of Claim 23 wherein R^{40} and R^{41} are different, R^{40} is a hydrocarbon group of from 4 to about 30 carbon atoms and R^{41} is a hydrocarbon group of from 1 to about 30 carbon atoms.

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25. The composition of Claim 22 where M^1 is zirconium, R^1 and R^2 are identical and are methyl, chlorine, or phenolate, R^3 is methyl, ethyl, n-propyl, n-butyl, n-pentyl or n-hexyl, $R^{3'}$ is iso-propyl, iso-butyl, n-butyl, sec-butyl, cyclobutyl, 1-methyl-butyl, 1-ethyl-butyl, 1-methyl-pentyl, cyclopentyl, cyclohexyl, cyclopent-2-enyl, cyclopent-3-enyl, cyclohex-2-enyl, cyclohex-3-enyl or para-methyl-cyclohexyl, R^4 and also $R^{4'}$ are hydrogen, and R^6 , R^7 , R^8 and also $R^{6'}$, $R^{7'}$ and $R^{8'}$ are identical or different and are each a hydrogen atom or a linear, cyclic or branched alkyl group of from 1 to about 10 carbon atoms, with or without a heteroatom, and, R^5 and $R^{5'}$ are identical or different and are p-isopropyl-phenyl, p-tert.-butyl-phenyl, p-s-butyl-phenyl, p-cyclohexyl-phenyl, p-trimethylsilyl-phenyl, p-adamantyl-phenyl, p-(trisfluor)trimethyl-phenyl, m,m'-dimethyl-phenyl, and R^9 is $R^{40}R^{41}Si=$ or $R^{40}R^{41}Ge=$, where R^{40} and R^{41} are identical or different and are propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclo-pentyl, cyclo-pentadienyl or cyclo-hexyl.

26. The composition of Claim 25 wherein R^{40} and R^{41} are different and R^{40} is butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclopentyl, cyclopentadienyl or cyclohexyl, and R^{41} is methyl, ethyl, propyl, butyl, pentyl, hexyl, heptyl, octyl, nonyl, decyl, undecyl, dodecyl, cyclopentyl, cyclopentadienyl or cyclohexyl.

27. The composition of Claim 1 wherein the synthesized compound is selected from the group consisting of:

- A-(2-isopropyl-4-(p-isopropyl-phenyl)indenyl)(2-methyl-4-(p-isopropyl-phenyl)indenyl)-zirconiumdichloride,
- A-(2-isopropyl-4-(p-tert. butyl-phenyl)indenyl)(2-methyl-4-(p-tert. butyl-phenyl)indenyl)-zirconiumdichloride,
- 5 A-(2-isopropyl-4-(p-tert. butyl-phenyl)indenyl)(2,7-dimethyl-4-(p-tert. butyl-phenyl)indenyl)-zirconiumdichloride,
- A-(2-isopropyl-4-(p-tert. butyl-phenyl)indenyl)(2,5,6,7-tetramethyl-4-(p-tert. butyl-phenyl)indenyl)-zirconiumdichloride,
- A-(2-isopropyl-6-methyl-4-(p-tert. butyl-phenyl)indenyl)(2,6-dimethyl-4-(p-tert. butyl-phenyl)indenyl)-zirconiumdichloride,
- 10 A-(2-isopropyl-4-(p-sec. butyl-phenyl)indenyl)(2-methyl-4-(p-sec. butyl-phenyl)indenyl)-zirconiumdichloride,
- A-(2-isopropyl-4-(p-cyclohexyl-phenyl)indenyl)(2-methyl-4-(p-cyclohexyl-phenyl)indenyl)-zirconiumdichloride,
- 15 A-(2-isopropyl-4-(p-trimethylsilyl-phenyl)indenyl)(2-methyl-4-(p-trimethylsilyl-phenyl)indenyl)-zirconiumdichloride,
- A-(2-isopropyl-4-(p-adamantyl-phenyl)indenyl)(2-methyl-4-(p-adamantyl-phenyl)indenyl)-zirconiumdichloride,
- A-(2-isopropyl-4-(p-tris(trifluoromethyl)methyl-phenyl)indenyl)(2-methyl-4-(p-tris(trifluoromethyl)methyl-phenyl)indenyl)-zirconiumdichloride,
- 20 A-(2-isopropyl-4-phenyl-indenyl)(2-methyl-4-(p-tert. butyl-phenyl)indenyl)-zirconiumdichloride;
- A-(2-isopropyl-4-(p-tert. butyl-phenyl)indenyl)(2-methyl-4-phenyl-indenyl)-zirconiumdichloride,
- 25 A-(2-isopropyl-4-(p-tert. butyl-phenyl)indenyl)(2,7-dimethyl-4-phenyl-indenyl)-zirconiumdichloride,
- A-(2-isopropyl-4-(p-tert. butyl-phenyl)indenyl)(2,5,6,7-tetramethyl-4-phenyl-indenyl)-zirconiumdichloride,
- A-(2-isopropyl-6-methyl-4-(p-tert. butyl-phenyl)indenyl)(2,6-dimethyl-4-phenyl-indenyl)-zirconiumdichloride,
- 30 indenyl)-zirconiumdichloride,

- A-(2-isopropyl-4-phenyl-indenyl)(2,7-dimethyl-4-(p-tert. butyl-phenyl)indenyl)-zirconiumdichloride,
- A-(2-isopropyl-4-phenyl-indenyl)(2,5,6,7-tetramethyl-4-(p-tert. butyl-phenyl)indenyl)-zirconiumdichloride,
- 5 A-(2-isopropyl-6-methyl-4-phenyl-indenyl)(2,6-dimethyl-4-(p-tert. butyl-phenyl)indenyl)-zirconiumdichloride,
- A-(2-isopropyl-4-(p-tert. butyl-phenyl)indenyl)(2-methyl-4-(4-naphthyl)-indenyl)indenyl)-zirconiumdichloride,
- A-(2-isopropyl-4-(4-naphthyl)-indenyl)indenyl)(2-methyl-4-(p-tert. butyl-phenyl)indenyl)-zirconiumdichloride,
- 10 A-bis(4-naphthyl-indenyl)zirconiumdichloride,
- A-bis(2-methyl-benzo-indenyl)zirconiumdichloride
- A-bis(2-methyl-indenyl)zirconiumdichloride,
- A-bis(2-methyl-4-(1-naphthyl)-indenyl)zirconiumdichloride,
- 15 A-bis(2-methyl-4-(2-naphthyl)-indenyl)zirconiumdichloride,
- A-bis(2-methyl-4-phenyl-indenyl)zirconiumdichloride,
- A-bis(2-methyl-4-t-butyl-indenyl)zirconiumdichloride,
- A-bis(2-methyl-4-isopropyl-indenyl)zirconiumdichloride,
- A-bis(2-methyl-4-ethyl-indenyl)zirconiumdichloride,
- 20 A-bis(2-methyl-4-acenaphth-indenyl)zirconiumdichloride,
- A-bis(2,4-dimethyl-indenyl)zirconiumdichloride,
- A-bis(2-ethyl-indenyl)zirconiumdichloride,
- A-bis(2-ethyl-4-ethyl-indenyl)zirconiumdichloride,
- A-bis(2-ethyl-4-phenyl-indenyl)zirconiumdichloride,
- 25 A-bis(2-methyl-4,6 diisopropyl-indenyl)zirconiumdichloride,
- A-bis(2-methyl-4,5 diisopropyl-indenyl)zirconiumdichloride,
- A-bis(2,4,6-trimethyl-indenyl)zirconiumdichloride,
- A-bis(2,5,6-trimethyl-indenyl)zirconiumdichloride,
- A-bis(2,4,7-trimethyl-indenyl)zirconiumdichloride,
- 30 A-bis(2-methyl-5-isobutyl-indenyl)zirconiumdichloride,
- A-bis(2-methyl-5-t-butyl-indenyl)zirconiumdichloride,

- A-bis(2-methyl-4-(tert-butyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-methyl-4-(4-methyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-methyl-4-(4-ethyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-methyl-4-(4-trifluoromethyl-phenyl)-indenyl)zirconiumdichloride,
 5 A-bis(2-methyl-4-(4-methoxy-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-ethyl-4-(4-tert-butyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-ethyl-4-(4-methyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-ethyl-4-(4-ethyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-ethyl-4-(4-trifluoromethyl-phenyl)-indenyl)zirconiumdichloride,
 10 A-bis(2-ethyl-4-(4-methoxy-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-methyl-4-(4-tert-butyl-phenyl)-indenyl)zirconiumdimethyl,
 A-bis(2-methyl-4-(4-methyl-phenyl)-indenyl)zirconiumdimethyl,
 A-bis(2-methyl-4-(4-ethyl-phenyl)-indenyl)zirconiumdimethyl,
 A-bis(2-methyl-4-(4-trifluoromethyl-phenyl)-indenyl)zirconiumdimethyl,
 15 A-bis(2-methyl-4-(4-methoxy-phenyl)-indenyl)zirconiumdimethyl,
 A-bis(2-ethyl-4-(4-tert-butyl-phenyl)-indenyl)zirconiumdimethyl,
 A-bis(2-ethyl-4-(4-methyl-phenyl)-indenyl)zirconiumdimethyl,
 A-bis(2-ethyl-4-(4-ethyl-phenyl)-indenyl)zirconiumdimethyl,
 A-bis(2-ethyl-4-(4-trifluoromethyl-phenyl)-indenyl)zirconiumdimethyl,
 20 A-bis(2-ethyl-4-(4-methoxy-phenyl)-indenyl)zirconiumdimethyl,
 A-bis(2-isopropyl-4-(tert-butyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-isopropyl-4-(4-methyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-isopropyl-4-(4-ethyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-isopropyl-4-(4-trifluoromethyl-phenyl)-indenyl)zirconiumdichloride,
 25 A-bis(2-isopropyl-4-(4-methoxy-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-isopropyl-4-(4'-tert.-butyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-isopropyl-4-(4'-tert.-butyl-phenyl)-indenyl)hafniumdichloride,
 A-bis(2-isopropyl-4-(4'-tert.-butyl-phenyl)-indenyl)titaniumdichloride,
 A-bis(2-isopropyl-4-(4'-methyl-phenyl)-indenyl)zirconiumdichloride,
 30 A-bis(2-isopropyl-4-(4'-n-propyl-phenyl)-indenyl)zirconiumdichloride,
 A-bis(2-isopropyl-4-(4'-n-butyl-phenyl)-indenyl)zirconiumdichloride,

- A-bis(2- isopropyl -4-(4'-hexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2- isopropyl -4-(4'-sec-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2- isopropyl -4-phenyl)-indenyl)zirconiumdichloride,
A-bis(2- isopropyl-4-(4'-methyl-phenyl)-indenyl)zirconiumdichloride,
5 A-bis(2- isopropyl -4-(4'-ethyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2- isopropyl-4-(4'-n-propyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2- isopropyl -4-(4'-n-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2- isopropyl -4-(4'-hexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2- isopropyl -4-(4'-pentyl-phenyl)-indenyl)zirconiumdichloride,
10 A-bis(2- isopropyl -4-(4'-cyclohexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2- isopropyl-4-(4'-sec-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2- isopropyl-4-(4'-tert.-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-methyl-4-(4'-tert.-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-methyl-4-(4'-tert.-butyl-phenyl)-indenyl)hafniumdichloride,
15 A-bis(2-methyl-4-(4'-tert.-butyl-phenyl)-indenyl)titaniumdichloride,
A-bis(2-methyl-4-(4'-methyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-methyl-4-(4'-n-propyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-methyl-4-(4'-n-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-methyl-4-(4'-hexyl-phenyl)-indenyl)zirconiumdichloride,
20 A-bis(2-methyl-4-(4'-sec-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-ethyl-4-phenyl-indenyl)zirconiumdichloride,
A-bis(2-ethyl-4-(4'-methyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-ethyl-4-(4'-ethyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-ethyl-4-(4'-n-propyl-phenyl)-indenyl)zirconiumdichloride,
25 A-bis(2-ethyl-4-(4'-n-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-ethyl-4-(4'-hexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-ethyl-4-(4'-pentyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-ethyl-4-(4'-cyclohexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-ethyl-4-(4'-sec-butyl-phenyl)-indenyl)zirconiumdichloride,
30 A-bis(2-ethyl-4-(4'-tert.-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-propyl-4-phenyl-indenyl)zirconiumdichloride,

- A-bis(2-n-propyl-4-(4'-methyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-propyl-4-(4'-ethyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-propyl-4-(4'-iso-propyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-propyl-4-(4'-n-butyl-phenyl)-indenyl)zirconiumdichloride,
5 A-bis(2-n-propyl-4-(4'-hexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-propyl-4-(4'-cyclohexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-propyl-4-(4'-sec-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-propyl-4-(4'-tert.-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-butyl-4-phenyl-indenyl)zirconiumdichloride,
10 A-bis(2-n-butyl-4-(4'-methyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-butyl-4-(4'-ethyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-butyl-4-(4'-n-propyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-butyl-4-(4'-iso-propyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-butyl-4-(4'-n-butyl-phenyl)-indenyl)zirconiumdichloride,
15 A-bis(2-n-butyl-4-(4'-hexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-butyl-4-(4'-cyclohexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-butyl-4-(4'-sec-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-n-butyl-4-(4'-tert.-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-hexyl-4-phenyl-indenyl)zirconiumdichloride,
20 A-bis(2-hexyl-4-(4'-methyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-hexyl-4-(4'-ethyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-hexyl-4-(4'-n-propyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-hexyl-4-(4'-iso-propyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-hexyl-4-(4'-n-butyl-phenyl)-indenyl)zirconiumdichloride,
25 A-bis(2-hexyl-4-(4'-n-hexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-hexyl-4-(4'-cyclohexyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-hexyl-4-(4'-sec-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-hexyl-4-(4'-tert.-butyl-phenyl)-indenyl)zirconiumdichloride,
A-bis(2-methyl-4-(4'-tert.-butyl-phenyl)-indenyl)zirconiumbis(dimethylamine),
30 A-bis(2-ethyl-4-(4'-tert.-butyl-phenyl)-indenyl)zirconiumdibenzyl,
A-bis(2-methyl-4-(4'-tert.-butyl-phenyl)-indenyl)zirconiumdimethyl,

- A-(2-methyl-4-azapentalene)(2-methyl-4-(4'-methyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-5-azapentalene)(2-methyl-4-(4'-methyl-phenyl)-indenyl)-
zirconiumdichloride,
- 5 A-(2-methyl-6-azapentalene)(2-methyl-4-(4'-methyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-4-azapentalene)(2-methyl-4-(4'-ethyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-4-thiapentalene)(2-methyl-4-(4'-n-propyl-phenyl)-indenyl)-
10 zirconiumdichloride,
- A-(2-methyl-4-azapentalene)(2-methyl-4-(4'-isopropyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-6-azapentalene)(2-methyl-4-(4'-isopropyl-phenyl)-indenyl)-
zirconiumdichloride,
- 15 A-(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-isopropyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-6-oxapentalene)(2-methyl-4-(4'-isopropyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-6-azapentalene)(2-methyl-4-(4'-n-butyl-phenyl)-indenyl)-
20 zirconiumdichloride,
- A-(2-methyl-5-thiapentalene)(2-methyl-4-(4'-n-butyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-4-oxapentalene)(2-methyl-4-(4'-n-butyl-phenyl)-indenyl)-
zirconiumdichloride,
- 25 A-(2-methyl-4-thiapentalene)(2-methyl-4-(4'-s-butyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-4-oxapentalene)(2-methyl-4-(4'-s-butyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-4-azapentalene)(2-methyl-4-(4'-tert-butyl-phenyl)-indenyl)-
30 zirconiumdichloride,

- A-(2-methyl-6-azapentalene)(2-methyl-4-(4'-tert-butyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-4-azapentalene)(2-methyl-4-(4'-n-pentyl-phenyl)-indenyl)-
zirconiumdichloride,
- 5 A-(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-n-pentyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-4-oxapentalene)(2-methyl-4-(4'-n-pentyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-4-azapentalene)(2-methyl-4-(4'-n-hexyl-phenyl)-indenyl)-
10 zirconiumdichloride,
- A-(2-methyl-4-thiapentalene)(2-methyl-4-(4'-n-hexyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-6-thiapentalene)(2-methyl-4-(4'-n-hexyl-phenyl)-indenyl)-
zirconiumdichloride,
- 15 A-(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-n-hexyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-n-hexyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2,5-dimethyl-6-thiapentalene)(2-methyl-4-(4'-cyclohexyl-phenyl)-indenyl)-
20 zirconiumdichloride,
- A-(2-methyl-4-azapentalene)(2-methyl-4-(4'-trimethylsilyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-4-thiapentalene)(2-methyl-4-(4'-trimethylsilyl-phenyl)-indenyl)-
zirconiumdichloride,
- 25 A-(2-methyl-5-thiapentalene)(2-methyl-4-(4'-trimethylsilyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2-methyl-6-thiapentalene)(2-methyl-4-(4'-trimethylsilyl-phenyl)-indenyl)-
zirconiumdichloride,
- A-(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-adamantyl-phenyl)-indenyl)-
30 zirconiumdichloride,

- A-(2-methyl-4-thiapentalene)(2-methyl-4-(4'-adamantyl-phenyl)-indenyl)-zirconiumdichloride,
- A-(2-methyl-6-thiapentalene)(2-methyl-4-(4'-adamantyl-phenyl)-indenyl)-zirconiumdichloride,
- 5 A-(2,5-dimethyl-4-thiapentalene)(2-methyl-4-(4'-adamantyl-phenyl)-indenyl)-zirconiumdichloride,
- A-(2-methyl-4-azapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methyl-phenyl)-indenyl)- zirconiumdichloride,
- A-(2,5-dimethyl-4-azapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methyl-phenyl)-indenyl) zirconiumdichloride,
- 10 A-(2-methyl-4-thiapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methyl-phenyl)-indenyl)zirconiumdichloride,
- A-(2-methyl-6-thiapentalene)(2-methyl-4-(4'-tris(trifluoromethyl)methyl-phenyl)-indenyl)zirconiumdichloride,
- 15 A-(2-methyl-4-azapentalene)(2-ethyl-4-(4'-tert-butyl-phenyl)-indenyl)-zirconiumdichloride,
- A-(2-methyl-5-azapentalene)(2-n-butyl-4-(4'-tert-butyl-phenyl)-indenyl)-zirconiumdichloride,
- A-(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4-(4'-tert-butyl-phenyl)-indenyl)-zirconiumdichloride,
- 20 A-(2-methyl-4-azapentalene)(2-methylindenyl) zirconiumdichloride,
- A-(2-methyl-N-phenyl-4-azapentalene)(2-methylindenyl) zirconiumdichloride,
- A-(2-methyl-4-thiapentalene)(2-methylindenyl)zirconiumdichloride,
- A-(2-methyl-5-thiapentalene)(2-methylindenyl)zirconiumdichloride,
- 25 A-(2-methyl-6-thiapentalene)(2-methylindenyl)zirconiumdichloride,
- A-(2-methyl-4-azapentalene)(indenyl) zirconiumdichloride,
- A-(2-methyl-5-azapentalene)(indenyl) zirconiumdichloride,
- A-(2-methyl-6-azapentalene)(indenyl) zirconiumdichloride,
- A-(2-methyl-N-phenyl-4-azapentalene)(indenyl) zirconiumdichloride,
- 30 A-(2-methyl-N-phenyl-5-azapentalene)(indenyl) zirconiumdichloride,
- A-(2-methyl-N-phenyl-6-azapentalene)(indenyl) zirconiumdichloride,

- A-(2,5-dimethyl-N-phenyl-6-azapentalene)(indenyl) zirconiumdichloride,
A-(2-methyl-4-thiapentalene)(indenyl)zirconiumdichloride,
A-(2-methyl-5-thiapentalene)(indenyl)zirconiumdichloride,
A-(2-methyl-6-thiapentalene)(indenyl)zirconiumdichloride,
5 A-(2,5-dimethyl-4-thiapentalene)(indenyl) zirconiumdichloride,
A-(2-methyl-4-azapentalene)(2-methyl-4-phenyl-indenyl) zirconiumdichloride,
A-(2-methyl-5-azapentalene)(2-methyl-4-phenyl-indenyl) zirconiumdichloride,
A-(2-methyl-6-azapentalene)(2-methyl-4-phenyl-indenyl) zirconiumdichloride,
A-(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4-phenyl-indenyl)
10 zirconiumdichloride,
A-(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4-phenyl-indenyl)
zirconiumdichloride,
A-(2-methyl-4-thiapentalene)(2-methyl-4-phenyl-indenyl)zirconiumdichloride,
A-(2-methyl-5-thiapentalene)(2-methyl-4-phenyl-indenyl)zirconiumdichloride,
15 A-(2-methyl-6-thiapentalene)(2-methyl-4-phenyl-indenyl)zirconiumdichloride,
A-(2-methyl-4-oxapentalene)(2-methyl-4-phenyl-indenyl)zirconiumdichloride,
A-(2-methyl-4-azapentalene)(2-methyl-4,5-benzo-indenyl) zirconiumdichloride,
A-(2-methyl-N-phenyl-4-azapentalene)(2-methyl-4,5-benzo-indenyl)
zirconiumdichloride,
20 A-(2-methyl-N-phenyl-5-azapentalene)(2-methyl-4,5-benzo-indenyl)
zirconiumdichloride,
A-(2-methyl-N-phenyl-6-azapentalene)(2-methyl-4,5-benzo-indenyl)
zirconiumdichloride,
A-(2-methyl-4-thiapentalene)(2-methyl-4,5-benzo-indenyl)zirconiumdichloride,
25 A-(2-methyl-5-thiapentalene)(2-methyl-4,5-benzo-indenyl)zirconiumdichloride,
A-(2-methyl-6-thiapentalene)(2-methyl-4,5-benzo-indenyl)zirconiumdichloride,
A-(2-methyl-4-oxapentalene)(2-methyl-4,5-benzo-indenyl)zirconiumdichloride,
A-(2-methyl-5-oxapentalene)(2-methyl-4,5-benzo-indenyl)zirconiumdichloride,
A-(2-methyl-6-oxapentalene)(2-methyl-4,5-benzo-indenyl)zirconiumdichloride,
30 A-bis(2-methyl-4-azapentalene)zirconiumdichloride,
A-bis(2-methyl-N-phenyl-4-azapentalene) zirconiumdichloride,

A-bis(2-methyl-4-thiapentalene)zirconiumdichloride.

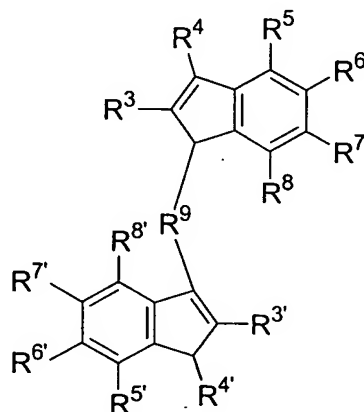
wherein

- 5 A is selected from the group consisting of structural isomers of
Dipropylsilanediyl, Dibutylsilanediyl, Dipentylsilanediyl, Dihexylsilanediyl,
Diheptylsilanediyl, Dioctylsilanediyl, Dinonylsilanediyl, Didecylsilanediyl,
Diundecylsilanediyl, Didodecylsilanediyl, Dipropylgermanediyl,
Dibutylgermanediyl, Dipentylgermanediyl, Dihexylgermanediyl,
10 Diheptylgermanediyl, Dioctylgermanediyl, Dinonylgermanediyl,
Didecylgermanediyl, Diundecylgermanediyl or Didodecylgermanediyl,
Hexyl(methyl)germanediyl, Butyl(methyl)silanediyl, Butyl(ethyl)silanediyl,
Butyl(propyl)silanediyl, Pentyl(methyl)silanediyl, Pentyl(ethyl)silanediyl,
Pentyl(propyl)silanediyl, Hexyl(methyl)silanediyl, Hexyl(ethyl)silanediyl and
15 Hexyl(propyl)silanediyl.

28. The composition of Claim 27 where the units A are:

- Di-n-propylsilanediyl, Di-n-butylsilanediyl, Di-n-pentylsilanediyl,
Di(cyclopentyl)silanediyl, Di-n-hexylsilanediyl, Cyclohexyl(methyl)silanediyl, (n-
20 butyl)(methyl)silanediyl or (n-hexyl)(methyl)silanediyl.

29. A compound of the formula:

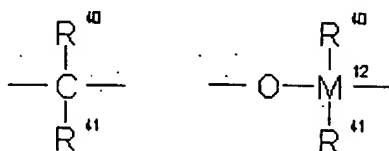


(formula LS)

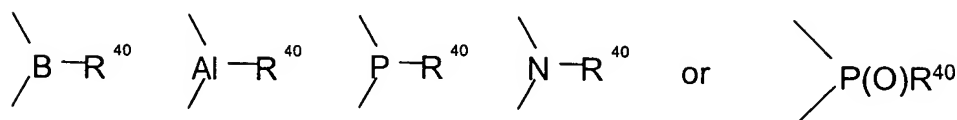
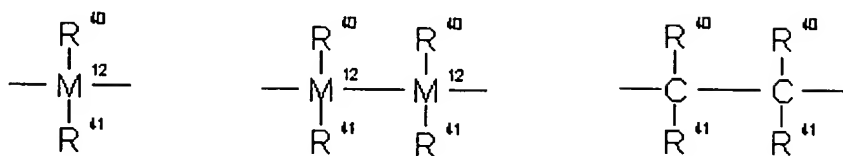
or its double bond isomers, wherein

R⁹ is a bridge having one of the structures:

5



10



where R⁴⁰ and R⁴¹, can be identical or different, with or without heteroatoms, and are each an alkyl group of from 2 to about 30 carbon atoms, a fluoroalkyl group of from 2 to about 10 carbon atoms, an alkoxy group of from 2 to about 10

15 carbon atoms, an aryloxy group of from 6 to about 10 carbon atoms, an alkenyl group of from 3 to about 10 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group of from 7 to about 40 carbon atoms, a substituted or unsubstituted alkylsilyl or arylsilyl group, or an arylalkenyl group of from 8 to about 40 carbon atoms, or R⁴⁰ and R⁴¹ together with any atoms

20 connecting them form one or more ring systems, and with the proviso that if R⁴⁰ and R⁴¹ are different and R⁴⁰ is a hydrocarbon group of from 4 to about 40 carbon atoms, R⁴¹ is a hydrocarbon group of from 1 to about 40 carbon atoms,

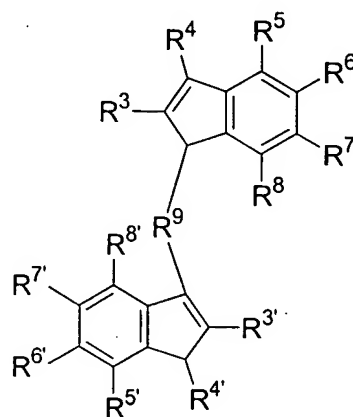
M¹² is silicon, germanium or tin, and

25 R³, R⁴, R⁵, R⁶, R⁷, R⁸ and also R^{3'}, R^{4'}, R^{5'}, R^{6'}, R^{7'} and R^{8'} are identical or different and are each a hydrogen atom, or a linear, cyclic or branched hydrocarbon group, with or without heteroatoms, selected from the group consisting of an alkyl group of from 1 to about 10 carbon atoms, an alkenyl group of from 2 to about 10 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group

of from 7 to about 40 carbon atoms or an arylalkenyl group of from 8 to about 40 carbon atoms, a substituted or unsubstituted alkylsilyl or arylsilyl group, with the proviso that R^3 and $R^{3'}$ are not hydrogen, or wherein two adjacent radicals R^5 , R^6 or $R^{5'}$, $R^{6'}$, or R^6 , R^7 or $R^{6'}$, R^7 , or R^7 , R^8 or $R^{7'}$, R^8 can form one or more hydrocarbon ring system(s).

30. A process for the production of a mixture of racemic and meso isomers of metallocene compounds comprising the steps of:

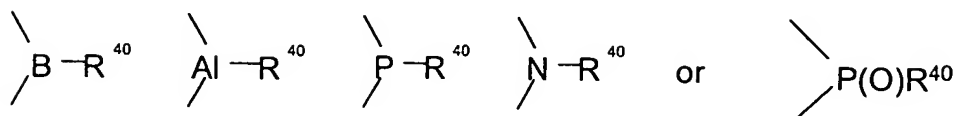
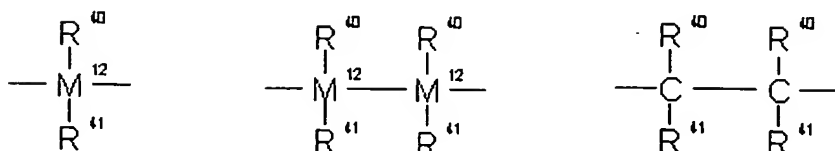
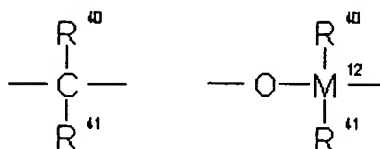
a) providing a ligand system of the formula



(formula LS)

wherein

R^9 is a bridge having one of the structures:

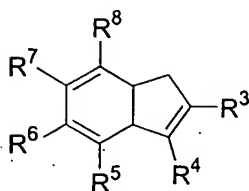


where R^{40} and R^{41} , can be identical or different, with or without heteroatoms, and are each an alkyl group having from 2 to about 30 carbon atoms, a fluoroalkyl group of from 2 to about 10 carbon atoms, an alkoxy group of from 2 to about 10 carbon atoms, an aryloxy group of from 6 to about 10 carbon atoms, an alkenyl group of from about 3 to about 10 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group of from 7 to about 40 carbon atoms, a substituted or unsubstituted alkylsilyl or arylsilyl group, or an arylalkenyl group of from 8 to about 40 carbon atoms, or R^{40} and R^{41} together with the atoms connecting them can form one or more cyclic systems, and if R^{40} and R^{41} are different and R^{40} is a hydrocarbon group of from about 4 to about 40 carbon atoms, R^{41} is a hydrocarbon group of from 1 to about 40 carbon atoms,

M^{12} is silicon, germanium or tin, and

$R^3, R^4, R^5, R^6, R^7, R^8$ and also $R^{3'}, R^{4'}, R^{5'}, R^{6'}, R^{7'}$ and $R^{8'}$ are identical or different and are each a hydrogen atom, or a linear, cyclic or branched group, with or without heteroatoms, selected from the group consisting of an alkyl group of from 1 to about 10 carbon atoms, an alkenyl group of from 2 to about 10 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group of from 7 to about 40 carbon atoms or an arylalkenyl group of from 8 to about 40 carbon atoms, a substituted or unsubstituted alkylsilyl or arylsilyl group, with the proviso that R^3 and $R^{3'}$ are not hydrogen, or wherein two adjacent radicals R^5, R^6 or $R^{5'}, R^{6'}$, or R^6, R^7 or $R^{6'}, R^{7'}$, or R^7, R^8 or $R^{7'}, R^{8'}$ can form one or more hydrocarbon ring system(s),

wherein said ligand system is produced by deprotonation of a compound of the formula



(formula 2)

5 with a base in an inert solvent at temperatures of -70°C to 80°C ; and,

b) combining said ligand system of formula LS with a compound having the formula M^1X_4 at a temperature of from about -70°C to about 80°C , wherein M^1 is zirconium, titanium or hafnium and X is a halogen, to provide a
10 metallocene compound(s) having a weight ratio of racemic to meso isomers of greater than 5:1 as synthesized.

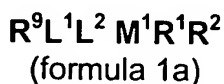
31. The process of Claim 30 wherein the weight ratio of racemic to meso isomers is greater than 10:1 without any further separation of racemic from
15 meso isomers.

32. The process of Claim 30 wherein the weight ratio of racemic to meso isomers is greater than 15:1 without any further separation of racemic from meso isomers.
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33. The process of Claim 30 wherein the weight ratio of racemic to meso isomers is greater than 20:1 without any further separation of racemic isomers from meso isomers.

25 34. A catalyst composition comprising:

a) mixed isomers of at least one metallocene compound having the formula 1a:

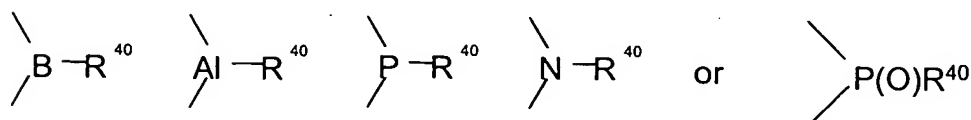
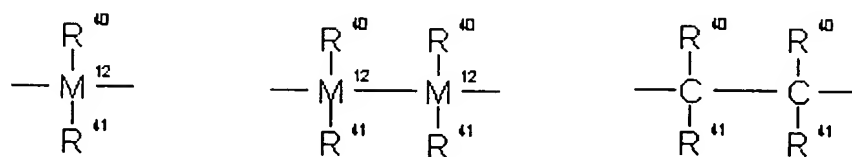
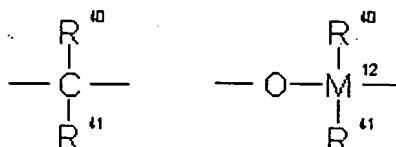


where L^1 and L^2 are identical or different ligands and are each a substituted mononuclear or polynuclear hydrocarbon radical selected from the group consisting of substituted cyclopentadienyl, indenyl, tetrahydroindenyl, azurenyl, fluorenyl, azapentalenyl, thiapentalenyl or oxapentalenyl, which form a sandwich structure with atom M^1 , therebetween,

R^1 and R^2 are identical or different and are each a hydrogen atom, an alkyl group of from 1 to about 10 carbon atoms, an alkoxy group of from 1 to about 10 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, an aryloxy group of from about 6 to about 10 carbon atoms, an alkenyl group of from 2 to about 10 carbon atoms, an OH group, a halogen atom, or a NR_2^{32} group, where R^{32} is an alkyl group of from 1 to about 10 carbon atoms or an aryl group of from 6 to about 14 carbon atoms, or R^1 and R^2 form one or more ring system(s),

M^1 is a metal of group IVb of the Periodic Table of the Elements,

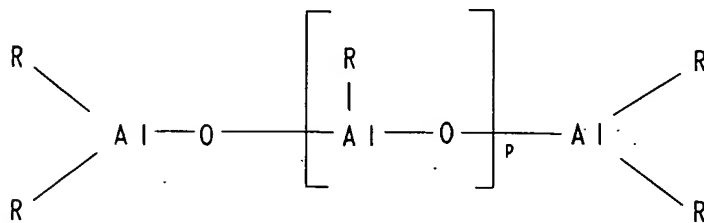
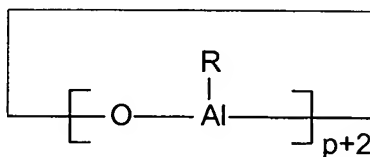
R^9 is a bridge between the ligands L^1 and L^2 having one of the structures:



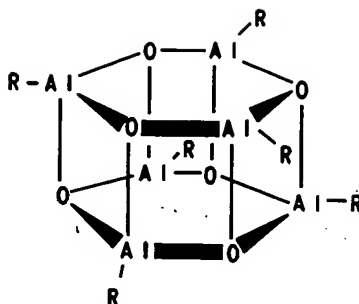
where R^{40} and R^{41} , can be identical or different, with or without heteroatoms, and are each an alkyl group having from 2 to about 30 carbon atoms, a fluoroalkyl group of from 2 to about 10 carbon atoms, an alkoxy group of from 2 to about 10 carbon atoms, an aryloxy group of from 6 to about 10 carbon atoms, an alkenyl

- group of from about 3 to about 10 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group of from 7 to about 40 carbon atoms, a substituted or unsubstituted alkylsilyl or arylsilyl group, or an arylalkenyl group of from 8 to about 40 carbon atoms, or R^{40} and R^{41} together with the atoms
- 5 connecting them can form one or more cyclic systems, and if R^{40} and R^{41} are different and R^{40} is a hydrocarbon group of from about 4 to about 40 carbon atoms, R^{41} is a hydrocarbon group of from 1 to about 40 carbon atoms, M^{12} is silicon, germanium or tin, and
- wherein the compound as synthesized has a ratio of racemic or
- 10 pseudoracemic isomers to meso or pseudomeso isomers of greater than 5:1;
- b) at least one cocatalyst; and
- c) at least one porous support.

35. The catalyst composition of Claim 34 wherein the cocatalyst is an
- 15 aluminoxane having one of the following formulas



or,



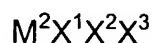
wherein R is hydrogen, an alkyl group of from 1 to about 6 carbon atoms, an aryl group of from 6 to about 18 carbon atoms, or benzyl, and p is an integer from 2 to 50.

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36. The catalyst composition system of Claim 35 wherein the atomic ratio of aluminum from the aluminosiloxane to the metal M^1 of the metallocene ranges from about 10:1 to about 1000:1.

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37. The catalyst composition of Claim 34 wherein the cocatalyst is a Lewis acid having the formula



wherein M^2 is selected from boron, aluminum or gallium, and

X^1 , X^2 and X^3 are the same or different and are each individually

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hydrogen, an alkyl group of from 1 to about 20 carbon atoms, an aryl group of from 6 to about 15 carbon atoms, or an alkaryl, aralkyl, halo-alkyl or haloaryl group having 1 to about 10 carbon atoms in the alkyl radical and from 6 to about 20 carbon atoms in the aryl radical, wherein the halogen component can be fluorine, chlorine, bromine or iodine.

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38. The catalyst composition of Claim 34 wherein the Lewis acid is selected from the group consisting of trimethylaluminum, triethylaluminum, triisobutylaluminum, tributylaluminum, trifluoroborane, triphenylborane, tris(4-fluorophenyl)borane, tris(3,5-difluorophenyl)borane, tris(4-fluoromethylphenyl)borane, tris(2,4,6-trifluorophenyl)borane, tris(penta-

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fluorophenyl)borane, tris(tolyl)borane, tris(3,5-dimethyl-phenyl)borane, tris(3,5-difluorophenyl)borane and tris (3,4,5-trifluorophenyl)borane.

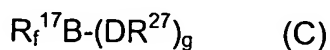
39. The catalyst composition of Claim 34 wherein the cocatalyst is an ionic compound containing a non-coordinating anion selected from the group consisting of tetrakis (pentafluorophenyl) borate, tetraphenylborate, SbF_6^- , CF_3SO_3^- and ClO_4^- .

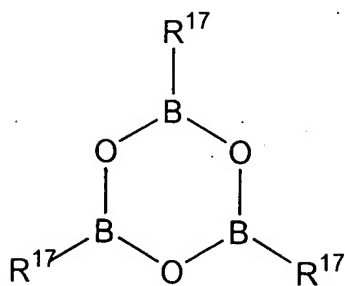
40. The catalyst composition of Claim 34 wherein the porous support is selected from the group consisting of inorganic oxides, inorganic salts, and polymer powders.

41. The catalyst composition of Claim 34 wherein the porous support is selected from the group consisting of silica, alumina, aluminosilicates, zeolites, MgO , ZrO_2 , TiO_2 , B_2O_3 , CaO , ZnO , ThO_2 , Na_2O , K_2O , Li_2O , Na_2CO_3 , K_2CO_3 , CaCO_3 , MgCl_2 , Na_2SO_4 , $\text{Al}_2(\text{SO}_4)_3$, BaSO_4 , KNO_3 , $\text{Mg}(\text{NO}_3)_2$, $\text{Al}(\text{NO}_3)_3$ and combinations thereof.

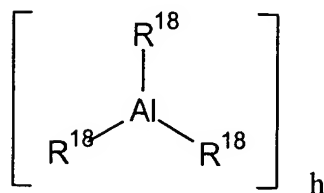
42. The catalyst system of Claim 34 wherein the porous support is selected from the group consisting of polyethylene, polypropylene, polybutene, polystyrene, divinylbenzene crosslinked polystyrene, polyvinyl chloride, acrylonitrile-butadiene-styrene copolymer, polyamide, polymethacrylate, polycarbonate, polyester, polyacetal or polyvinyl alcohol.

43. The catalyst composition of Claim 34 wherein the cocatalyst is a reaction product of at least one compound of formulas (C) and/or (D) and/or (E) with at least one compound of formula (F),





(E)



(F)

5. where

R^{27} is a hydrogen atom or a boron-free C_1 - C_{40} carbon-containing group, selected from an alkyl group of from 1 to about 20 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms or an alkylaryl group of from 7 to about 40 carbon atoms,

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R^{17} and R^{18} are the same or different and are a hydrogen atom, a halogen atom, or a C_1 - C_{40} carbon-containing group, selected from an alkyl group of from 1 to about 20 carbon atoms, a haloalkyl group of from 1 to about 20 carbon atoms, an alkoxy group of from 1 to about 10 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, a haloaryl group of from 6 to about 20 carbon atoms, an aryloxy group of from 6 to about 20 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, a haloarylalkyl group of from 7 to about 40 carbon

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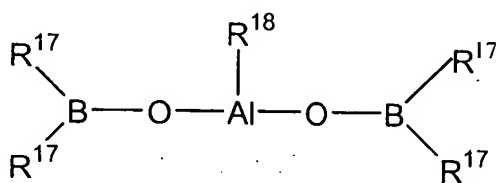
atoms, an alkylaryl group of from 7 to about 40 carbon atoms or a haloalkylaryl group of from 7 to about 40 carbon atoms or R^{17} may also be an $-OSi^{51}_3$ group,

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in which the R^{51} groups are the same or different and have the same meaning as R^{17} ,

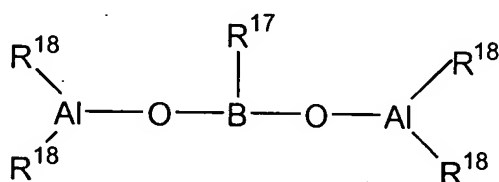
- D is an element of main Group VI of the periodic table of elements or an NR^{61} group, where R^{61} is a hydrogen atom or a $\text{C}_1\text{-C}_{20}$ hydrocarbon group, selected from an alkyl group of from 1 to about 20 carbon atoms, or an aryl group of from 6 to about 20 carbon atoms,
- 5 f is a whole number from 0 to 3,
- g is a whole number from 0 to 3 with $z + y$ not equal to 0, and
- h is a whole number from 1 to 10.

- 10 44. The catalyst composition of Claim 34 wherein the cocatalyst is a compound or a mixture of compounds of formulas (A) and/or (B)



(A)

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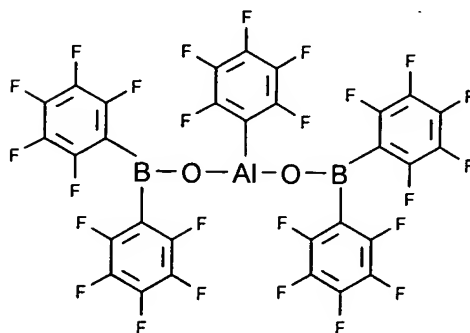
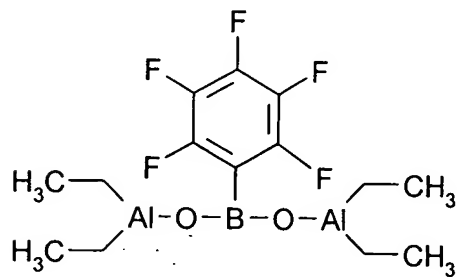
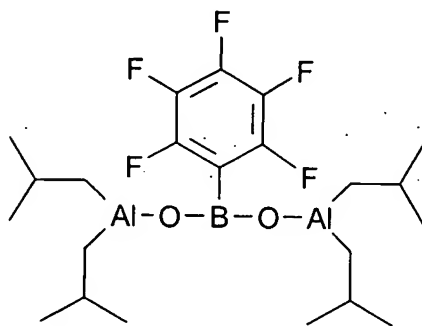
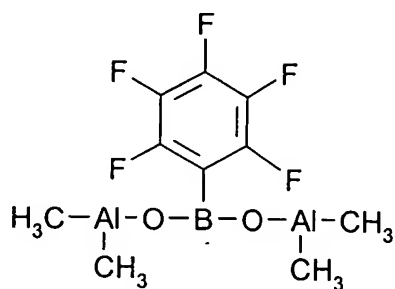


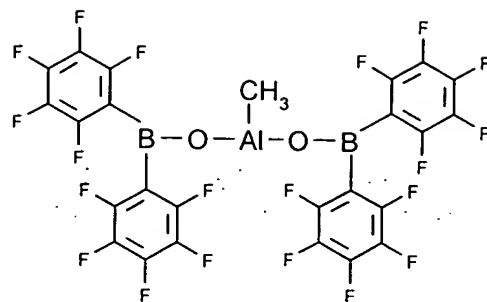
(B)

- where R^{17} and R^{18} are the same or different and are a hydrogen atom, a halogen atom, a $\text{C}_1\text{-C}_{40}$ carbon-containing group, selected from an alkyl group of from 1 to about 20 carbon atoms, a haloalkyl group of from 1 to about 20 carbon atoms, an alkoxy group of from 1 to about 10 carbon atoms, an aryl group of from 6 to about 20 carbon atoms, a haloaryl group of from 6 to about 20 carbon atoms, an aryloxy group of from 6 to about 20 carbon atoms, an arylalkyl group of from 7 to about 40 carbon atoms, a haloarylalkyl group of from 7 to about 40 carbon atoms, an alkylaryl group of from 7 to about 40 carbon atoms or a haloalkylaryl
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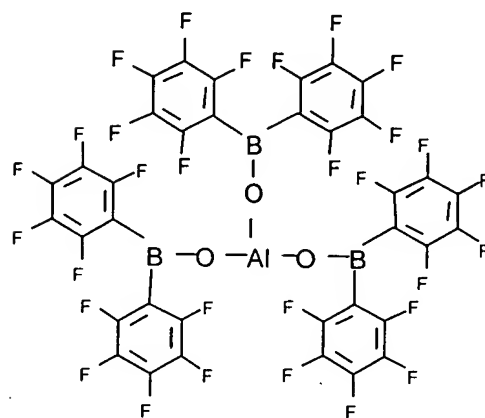
group of from 7 to about 40 carbon atoms or R^{17} may also be an $-\text{OSiR}^{51}_3$ group, where the R^{51} groups are the same or different and have the same meaning as R^{17} .

- 5 45. The catalyst composition of Claim 34 wherein the cocatalyst is a compound or a mixture of compounds of the following formulas



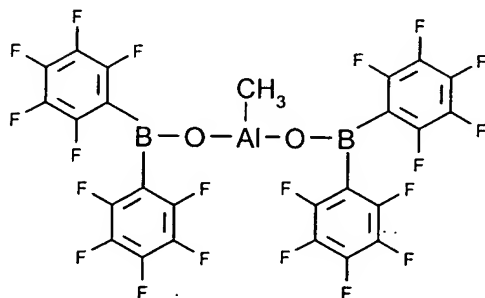


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46. The catalyst composition of Claim 34 wherein the cocatalyst is



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53. A process for the polymerization of olefins comprising contacting one or more olefins each having from about 2 to about 20 carbon atoms under polymerization reaction conditions with the catalyst composition of Claim 34.

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54. A process for the polymerization of olefins comprising contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with the catalyst composition of Claim 35.

10 55. A process for the polymerization of olefins comprising contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with the catalyst composition of Claim 36.

15 56. A process for the polymerization of olefins comprising contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with the catalyst composition of Claim 37.

20 57. A process for the polymerization of olefins comprising contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with the catalyst composition of Claim 38.

25 58. A process for the polymerization of olefins comprising contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with the catalyst composition of Claim 39.

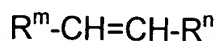
59. A process for the polymerization of olefins comprising contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with the catalyst composition of Claim 40.

60. A process for the polymerization of olefins comprising contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with the catalyst composition of Claim 41.

5 61. A process for the polymerization of olefins comprising contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with the catalyst composition of Claim 42.

62. The process of Claim 53 wherein at least one olefin is a 1-olefin.

10 63. The process of Claim 53 wherein at least one olefin has the formula



wherein R^m and R^n can be identical or different and are each individually a hydrogen atom or a radical having from 1 to about 20 carbon atoms or R^m and R^n together can form one or more rings.

15 64. The process of Claim 53 wherein the olefins include ethylene and one or more 1-olefins having from 4 to about 20 carbon atoms.

20 65. The process of Claim 53 wherein the olefins include propylene.

66. The process of Claim 53 wherein the olefins include propylene and ethylene.

25 67. The process of Claim 53 wherein the olefins include propylene and one or more 1-olefins having from 4 to about 20 carbon atoms.

68. The process of Claim 53 wherein the olefins include propylene, ethylene and one or more 1-olefins having from 4 to about 20 carbon atoms.

30 69. A process for the polymerization of olefins comprising:

contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with a catalyst composition including at least one compound having the formula 1a as set forth in claim 1.

5 70. A process for the polymerization of olefins comprising:
 contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with a catalyst composition including at least one compound having the formula 1b as set forth in claim 9.

10 71. A process for the polymerization of olefins comprising:
 contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with a catalyst composition including at least one compound having the formula 1c as set forth in claim 15.

15 72. A process for the polymerization of olefins comprising:
 contacting one or more olefins each having from 2 to about 20 carbon atoms under polymerization reaction conditions with a catalyst composition including at least one compound having the formula 1d as set forth in claim 22.